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OGDENSBURGH & LAKE CHAMPLAIN

RAILROAD.

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ENGINEER'S REPORT.

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R E P O R T

OF

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1847

SURVEYS AND ESTIMATES

FOR THE

NORTHERN RAILROAD

IN

NEW YORK.

BY JAMES HAYWARD.

BOSTON:

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1847.

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# R E P O R T .

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*To the President and Directors of the Northern Railroad in  
New York.*

GENTLEMEN, —

In compliance with your request, communicated July 28th, 1846, I proceeded, with the least possible delay, to organize parties for the surveys deemed necessary for the judicious location of the railroad to be constructed from Ogdensburgh to Lake Champlain; and was enabled to commence the necessary examinations on the twentieth of the following month. The advanced state of the season, and the amount of work necessarily involved in a survey of location for a railroad extending across one hundred and twenty miles of country, of a generally smooth surface, but through which no one line seemed to offer itself as superior to every other line which might be selected between the same *termini*, — seemed to render it expedient to bring into the field as large a force as could be employed to advantage, in order to ascertain as soon as might be, the facts upon which would depend the selection of the general route, and, if possible, the location of a large portion of the definite line. With this object in view, I organized three parties at the outset; and, after a reconnaissance of the country, — namely, in the early part of September, — I added the fourth.

The country through which this road is chartered, lies between the river St. Lawrence (at the foot of navigation of the great chain of lakes) and Lake Champlain; and embraces the three northern counties of the State of New York, namely, St. Lawrence, Franklin, and Clinton.

St. Lawrence County, in its northern portion, the part traversed by the proposed line of railroad, presents a very uniform surface, slightly undulating, but with no very considerable elevations. As you go south, the country rises; and in a distance from

the river of from fifteen to twenty miles, the sprouts of the hill country begin to be felt. The streams which water this country have their sources in the mountainous regions lying south, between the St. Lawrence valley and the valley of the Mohawk, and of course run in a northerly direction. The direction of the surveys, therefore, extending from east to west, is across the water-courses of the country; the intervening ridges of which, though seldom abrupt, are frequently too much inclined to the horizon, to admit of the location of a railroad of the *first class*, within a reasonable expense for excavation, embankment, and bridging. This fact made the work of examination laborious; as much of the country had to be surveyed before a line with the desired characteristics could be selected.

The county of *Franklin* lies upon the north-western declivity of an elevated portion of the country, which is properly the north end of the mountain region between the Mohawk valley and Canada, and which loses itself in the valley of the St. Lawrence, a short distance north of the boundary line. That portion of this county traversed by our survey, though more elevated than the portion of St. Lawrence county through which our survey passed, presents generally an even surface. The water-courses, however, are deeper, and the expense of bridging will be much greater; but, independent of the deep channels worn by the rivers, there are almost no undulations of the surface; the grade through this country being nearly a uniform ascent from the western to the eastern border, with occasional levels for the accommodation of the *stations*.

The crest of this promontory where it crosses the Canada line, is about *eleven hundred feet* above the level of the sea. It rises to the south for many miles inland, and is more broken in its character, so as to leave no doubt that the summit of the northern railroad must be not far from the Canada line. We have selected, as the most eligible point for crossing this ridge, a point about two and a half miles from the boundary line.

All the streams easterly of this summit run into Lake Champlain, through very irregular channels;—none of them taking the direction practicable for the railroad, for the first twenty miles;—so that no regular valley or general line offered itself as an obvious location of the road. And what added to the difficulties of selecting the ground, was the fact that a large portion of this side-hill country, through which the survey must be carried, for fifteen or twenty miles, is a dense forest; so that, in making our reconnaissance, it was difficult to compare portions of the surface among themselves; and that whole region had to be felt out with the levelling instrument, in order to find a *practicable line* for the road.

Though we have not settled the line exactly, in any part of

this division, we have accomplished all that I expected to be able to effect during the season which has just closed; and even more: we have cross-sectioned the country throughout this entire region, from the summit to the open country bordering upon the lake, so as to know its entire capabilities, and have the means of making a location of the road, whenever we shall have settled the *Eastern terminus* of the line. Indeed, the surveys which have been made on the eastern side of the summit have settled the important questions of feasibility, the general character of the road of which the country is capable, and the probable cost of such a road. But we have not had time to make, on the east side of the summit, those minute and thorough surveys upon which the *definite location* of the line will depend. Nor was it worth while to do this till we had obtained that knowledge of the shores, channels, and harbors of the lake, and of the navigation of the same, which is necessary for the judicious selection both of a maritime depot, for that portion of the business connected with the navigation of the lake, and a suitable and convenient crossing, to enable us to deliver a portion of our freight and travel on the shores of Vermont.

A large amount of business at the east end of the road, will be connected with the water craft of Lake Champlain, and the navigation of the Northern Canal, to be carried to the Hudson river. The accommodation of this business will require, 1. A safe and commodious harbor; 2. A long line of wharf room, approachable by way of the railroad in the direction of its length; 3. An ample depth of water for all the varieties of craft used or to be used on the lake. So also with regard to the crossing of the lake. Whether this crossing is to be at the same place with the lake depot, or *not*, it is important to select a location which will allow the freight trains to cross with the greatest possible safety at all times, and with the readiest dispatch. All these important *desiderata* are not to be certainly secured, but with a good deal of careful examination, and with more observation of the lake and its business than I have yet had opportunity to make.

Agreeably to the instructions of the Executive Committee of the Board of Directors, we have surveyed "two general routes, one upper and one lower one,"—or a Southern and a Northern one,—through that portion of the distance in which practicable rival routes exist, namely, from Ogdensburgh to Moira. Each of these routes has several collateral lines.

The *Southern* or "*Upper Route*" takes a south-easterly direction from the village of Ogdensburgh towards the village of Canton, on the northerly side of the Turnpike, nearly parallel thereto, and at an average distance from the same of about *one mile*

This line is very straight: it crosses Grasse river, — a stream, at that place, of about 300 feet in width, — about three and a half miles north of Canton village; and continues nearly the same direction, to a point about one and a half miles from said village. From this point the line curves to the east, making about sixty degrees of deflection, but with a large radius, — a degree of curvature perfectly easy in a line of railway. From this curve, — which is the most considerable one on this route, between Ogdensburgh and Moira, — the line is nearly straight to Potsdam village, a distance of about ten miles. At Potsdam this line crosses the Racket river, just below the centre of the village; at which point a suspension bridge, of about six hundred feet in length, will be required.

From Potsdam the course is north-easterly, with slight changes of direction, but with none requiring objectionable curves, — crossing the West Branch of the St. Regis river at the small village of Bicknelville, in the west part of Stockholm, and crossing the East Branch at a point about a mile south of the East village in Stockholm. Near the eastern part of Stockholm, the direction of the line is a little more easterly, to Lawrenceville, and then more north-easterly, to Moira. It is to be remarked that the changes of direction in this line involve no objectionable curvature; none of the curves, excepting that by which the line leaves the station in the village of Ogdensburgh, requiring a less radius than five thousand feet; and about fifty miles of the distance, out of fifty-three miles, is straight line. The character of this line, as well as that of others, will be best understood from the accompanying drawings. The profile shows heavy work on the west side of Grasse river; also in the neighborhood of Canton village, in the neighborhood of Potsdam, and in the town of Stockholm. We have, however, estimated for grades not exceeding 26.4 feet to the mile.

The earth formations on this line, from Ogdensburgh to Potsdam village, are generally gravel, with an admixture of aluminous earths. The excavation in Ogdensburgh will be more clayey; and that shown on the profile, near the village of Canton, will have an uncertain amount of *rock*. Rock also occurs in the westerly part of Potsdam. The high ground in the easterly part of Potsdam is mostly clay; and in Stockholm, clay, hard-pan, and loose rock, will be encountered. In the eastern part of Lawrence, and in Moira, the excavation will be generally gravel, except the slight cut west of Phillips' Brook. This will be hard-pan and boulders.

The *Northern* or "*Lower Route*" takes very nearly a direct course from Ogdensburgh to Moira, in the direction of Malone village. It passes through the southerly part of Madrid; the northerly

part of Potsdam, four and a half miles from Potsdam village; three and a half miles from Norfolk south village; six miles from Norfolk centre; one and a half miles from East Stockholm village; one mile south of Brasher's Falls; through the north village in Lawrence; near the village at Moira Four Corners; and unites with the southern route in Moira, 49.13 miles from Ogdensburgh.

This route is only about *one third* of a mile longer than a perfectly straight line between its extreme points, and has *necessarily* no curvature of a less radius than 10,000 feet, and no grade exceeding 26.4 feet to the mile; nearly half the distance is level, or with grades not exceeding ten feet to the mile; 43.75 miles of the 49.13 is straight line; and with curves of 5,000 feet radius, — the radius of the curves on the Canton line, — there will be 46.4 miles of straight line on this route. It is *four miles* shorter than the route through Canton; has *one hundred feet* less rise in each direction, and has no plane rising more than thirty-eight feet, without an intervening level or descent. The earth formations (with the exception of the first cut, at the bank of the St. Lawrence river, which is common to both routes) are gravel. There is no rock cutting, and probably no clay, on any part of the line. The river crossings are favorable; the water courses are not deep; the channels of the streams are generally *rock-bottom*; and there is an abundance of good material for the masonry required for the bridges, which will be generally of stone arches. A stratified limestone, varying in thickness from eight to eighteen inches, is found in the low grounds, at intervals, along the line; and generally in the bottom of the streams. This rock has preserved the rivers from being worn into deep channels, and gives, at the same time, a good foundation for the bridges, and an excellent and cheap material for their construction. None of this rock formation is believed to lie high enough to be in the way of the grade of the road.

This line passes through a good deal of low ground, but the bottom is generally firm; a foot or two of vegetable matter resting upon gravel or sand. There are four swamps in which this vegetable earth is several feet in thickness; but they all support a heavy growth of wood, and I have no doubt that they will sustain the required embankment of three or four feet of gravel. No attempt was made to avoid them, as they were thought to offer a level and cheap line for the construction of a good road. The embankments on this line will be of gravel: though it is not, all of it, the best of gravel for the dressing of the road-bed, it is more sandy, and will better sustain the superstructure in the changes of weather, than the material on the southern route.

*Comparison of the two Routes.*

The relative characteristics of the two located lines through St. Lawrence County, are as follows:—

1. *The amount of curvature* is not very different on the two lines, amounting only to 11 per cent. It is only  $17^{\circ}55'$  more on the Canton than on the Northern line; equal to a curve of 5,000 feet radius, about one-third of a mile in length. The Northern line, however, admits of giving these curves a radius of 10,000 feet; while those of the Canton route are only 5,000 feet.

2. *The maximum grade* is the same on both routes, 26·4 feet to the mile; but the Northern line has no plane rising more than thirty-eight feet, without an intervening level or descent; while on the Canton line, there are several planes of over sixty feet rise, and one that is over one hundred feet.

3. *The summits* are higher on the Canton line than they are on the Northern. There is 100 feet more rise in each direction on the Canton line, than on the Northern. There is 29 per cent. more rise and fall.

4. *The material* on the Northern line is generally better than on the other. The excavations and material for embankment will be gravel, and a good portion of it, of a dry character, suitable for the road-bed; while on the Canton route there will be extensive excavations in clayey earths, which are altogether unfitted for the road-bed. Embankments made of this material will settle in every change of weather from dry to wet; and will settle unequally, so as to put the road *out of surface*.

5. *The distance* by the Canton route is *four miles greater* than by the Northern line. The *equated* distance, as engineers reckon it, would be five miles more, or nine miles in all = 18 per cent.

6. *The cost* of the Canton route will be \$165,482, or 23 per cent. more than that of the Northern line, according to our estimates. This does not provide for the contingency of encountering rock in the cut near Canton village.

7. It will be perceived that *all* these characteristics are in favor of the Northern line; and it may be added, that this line will well accommodate *the public*,—will accommodate the *present* and the *probable* business of that section of country. It takes a direct course through the fertile valley of the St. Lawrence, and divides the distance between the principal important towns on each side, with a good degree of impartiality; and seems to me to have the proper reference to the elements of future growth, in that part of the country.

The two routes described above, unite at Moira, in the county of Franklin; a distance by the Northern line, from Ogdensburg, of 49·13 miles. From this point to the summit in Clinton, in the county of Clinton, we have properly no *rival routes*;—the country not admitting of any considerable freedom of range, in this



longitude, on the south side of the Canada line. In Malone, in Burke, and in Chateaugay, we surveyed several lines; but they were near each other, and were rivals only as it respected character and cost.

Another line was proposed by the citizens in the northern section of Franklin County, passing through the southerly part of Westville, and near to the village of Constable. Several days were spent in explorations on the route proposed; but it became manifest that this northern line was far inferior to that through Malone. On the located line from the crossing of Little Salmon river in Moira, to the crossing of Marble river in Clinton, 27.4 miles, we have an almost uniform ascent of about 23.5 feet to the mile, with grades nowhere exceeding 26.4 feet to the mile, and a few level plains to accommodate the stations. On the proposed route in Constable, at a point opposite Malone village, the grade line would be about 245 feet lower than the corresponding point on the located line; but at the crossing of the Chateaugay river these lines must come together, there being *no practicable route* by which to reach the Clinton summit, north of the "New Bridge" over the Chateaugay river. The point of crossing the Chateaugay river is 242 feet higher than the located line near Hosford's Hotel, in Malone, and consequently 487 feet higher than the corresponding point on the north line in the town of Constable. The distance from Malone to the Chateaugay river is 11.4 miles. Suppose the distance from Constable to the Chateaugay to be 12.175 miles, and we have an average rise of forty feet to the mile for the whole distance. It is evident, from mere inspection, that this rise of 487 feet, between Constable and Chateaugay, cannot be uniformly distributed through the line, within any reasonable expense. But grades of at least 50 feet to the mile would be required, if a line of tolerable directness should be maintained.

On the proposed line, the crossing of the Salmon river, and that of West Trout river, may be a trifle less expensive than the crossings of the same streams on the located line; but the other portions of the northern route would be generally more expensive. The portion of this line between Little Salmon river and Constable would be much more expensive than the corresponding part of the located line, if one of equal directness were established; so that we should gain nothing, and lose much in the character of the road, by taking the northern route through Franklin County.

The located line in this division is on the north side of the *north road*, and varies very little from a straight line for nearly ten miles. This brings us within about one and one-half miles of Malone village. At this point, the line, as located, curves

gently to the right, passing under the Fort Covington road, near Barnard's wood-lot, and approaches the village of Malone by a level grade of about a mile in length. It is proposed to cross the Salmon river at the village by a stone arch bridge of sixty feet span.

From the Salmon river the line passes through the eastern part of the village, by a compound curve of from two to three thousand feet radius, and crosses the back road to Chateaugay, about a mile from the village. It crosses the West Trout river by a double arch culvert; passes under the post-road near Chapman's; and continues the same general direction as before the *détour* by Malone village (and nearly in the same straight line), between the north and south roads, crossing the East Trout river near Smith's tavern in Burke, and continuing on the north side of, or near to, the post-road, to the neighborhood of the Chateaugay river.

We have surveyed several places for crossing this river. They are all difficult; and a crossing here will be somewhat expensive. The place selected as the most eligible point for crossing this river, is at a locality called *Little Falls*. A bridge at this place, of six hundred feet in length, and spans of one hundred and fifty feet, will enable us to reach the Clinton summit, without increasing our grade beyond 26.4 feet to the mile, which is the maximum in the previous part of the route.

From Chateaugay river the line passes a little to the south of the *Chateaugay Four Corners*; crosses the post-road from half a mile to a mile east of the same; and passes Marble river, on the confines of Clinton county, near the turnpike, four miles east of Chateaugay river. This brings us substantially to the summit, the remaining distance (about five miles) being nearly level, with slight elevations only.

Throughout this division, which is 32.86 miles, the maximum grade will be the same as in the western division, 26.4 feet to the mile. About four miles and a half will be level; and we have intermediate grades of thirteen feet to the mile. There are twenty-six miles and one-third of straight line. Five miles have a curvature of 5,000 feet radius; a little more than a mile of 3,000 feet radius; and 1,600 feet of 2,000 feet for the radius of curvature. This last curve is at the Malone station, where the trains will be moving at a moderate rate.

The bridges in this division will be more expensive than those on either of the routes in the western division. They will, however, be principally stone arches, as they can generally be built about as cheap of that material as of wood — an abundance of stratified rock being found in the immediate neighborhood of the streams.

The earth formations, in a large part of this division, consist of a mixture of gravel and argillaceous earth. There are, however, scattered through the division, deposits of excellent gravel, for dressing the road-bed. Rock will be encountered in several places: this is provided for in the estimates. There will, however, be no deep cutting in rock.

The summit which we have adopted, is substantially that selected by Mr. Brodhead, and is undoubtedly the most eligible point for crossing the highlands with a railroad south of the Canada line, or even for several miles north of that line. To the south-west of this point, the ground rises so much as to make it altogether impracticable to surmount the elevations which we should encounter even one mile farther south, without increasing our grades. And by running further to the north, very little would be gained in respect to elevation, while the approaches to the summit on either side would be rendered more difficult and expensive; and the distance would be proportionally increased by any nearer approach to the Canada line, in this vicinity. The grades would not be improved by adopting a more northern line. Controlling points, in this location of the summit, are the points of crossing the Chateaugay river on the west, and the Champlain river on the east. Neither of them can be crossed further to the north with our present grades (nor with any grades, at so low a cost of construction), without going several miles into Canada with the line of the road.

From the summit eastward or south-easterly, towards Lake Champlain, we have surveyed two general routes. The first is in the neighborhood of that surveyed by Mr. Brodhead, passing near the centre of Ellenburgh, and thence in the vicinity of the turnpike, or military road, which it crosses four times between Ellenburgh and the south branch of the Champlain river, and crosses this river about a quarter of a mile east of the turnpike; thence over the *Flat Rock region* (an extensive formation of stratified sandstone, which underlies the whole country for forty miles of our survey, but which lies high for eight or ten miles in this part, coming to the surface, and constituting the surface for miles in extent), crossing the Little Chazy river about two miles west of the Chazy Four Corners; and thence, on a slightly serpentine course (but with no curve in any part of the line of a less radius than 3,000 feet), to the landing at Plattsburg.

The great objections to this route are the great amount of rock that we encounter; the great want of material for the road-bed over this rock, and the very inconvenient distribution of the acclivity or elevation from the lake to the summit. Unless we adopt objectionable curvatures, there must be a good deal of rock excavation, or a very large amount of embankment to avoid it,

if we limit ourselves to a grade of forty feet for the maximum ; the rise in the first seventeen miles being thirty-seven feet and a half to the mile on an average, and the narrow margin of two feet and a half to the mile being altogether too little to allow us, in a country like this, a suitable selection of the ground for a location, with reference to curves and economy in construction. The remaining seventeen miles to the summit has an average rise of only twenty-three feet to the mile, and eight or nine miles of this is from thirty-seven to forty feet to the mile. The survey of this route, made in 1840, gives 19.4 miles of forty feet grade in this division.

The other line from the summit is more easterly, crossing the main branch of the Champlain river near the east line of Ellenburgh ; crossing the south branch about three miles from the military road ; and passing near *Ober's Corners*, in the northerly part of the township of Chazy. From the summit to this point, which is about twenty miles, the direction of the survey is east-south-east, oblique to the general slope of the country, and slightly serpentine, to conform to the varying surface, and, at the same time, to preserve, as nearly as we might, our assumed grade ; but with no necessary curvature in any part, having a less radius than 5,000 feet.

The line here described from the summit eastward is not offered as a *definite location*. It will probably, however, require to be very little varied for the first fifteen or twenty miles. Whatever line shall be finally adopted thence to the lake, it will be necessary to make the *table land* north-westerly of *Ober's Corners*, between the south branch of the Champlain and the Corbeau rivers.

This general line will best distribute the inclination from the summit to the more level ground bordering the lake ; the general average being about 33 feet to the mile, and the average from this *table land* to the summit being about  $34\frac{1}{2}$  feet to the mile. As we have laid our profile of the grades, there are two planes, amounting to about two and a half miles, which have an inclination of 39.6 feet to the mile. This is the maximum in this division. There is no plane ascending towards the east. A more northerly line would increase our grades from the summit thus far, beyond forty feet to the mile ; and a more southerly line would throw us on the *Flat Rock* country ; would add greatly to the expense of construction on that account ; would carry the line farther from the villages, and from the improved and *improvable* portion of the country ; and would increase the grades beyond our present maximum between the south branch of the Champlain river and the lake.

The superiority of this new line, or rather, *new route*, from the summit to Chazy, and thence to the lake, by either of the three lines which we have surveyed (but particularly to Plattsburgh), in comparison with the route across the *Flat Rock* region,—is, 1. That it avoids the inconvenient curves encountered on that route; the new line, when definitely located, having no curvature of a less *radius* than 4,000 feet, and probably not less than 5,000 feet. 2. It distributes the grades better through the whole distance from the lake to the summit, as was before stated. 3. It avoids almost entirely the Flat Rock region, and most of the *rock cutting*,—touching only some small spurs of it,—passing, in the corresponding portion of the line, over gravelly formations, with an intermingling of loose rock. 4. It passes nearer the villages, and nearer those portions of this district in which villages are likely to grow up.

From this table land, between the south branch of the Champlain and the Corbeau, we have surveyed *three lines* to the lake. One to Plattsburgh; one to Cumberland Head; and one to *Rouse's Point*, near the Fort in the neighborhood of the Canada line.

The line to Plattsburgh from this point of divergence is in a southerly direction, passing near the villages of Chazy *Four Corners*, Beekmantown *Four Corners*, and Beekmantown *South village*; and is generally over ground favorable for the grades and the cost of construction, till we reach the lake on the north side of the mouth of the Saranac River in the village of Plattsburgh. This survey proves the feasibility and the facility of reaching the lake in the neighborhood of Plattsburgh; but I have not yet such knowledge of the capabilities of the present landing and its vicinity, as to satisfy me with respect to the harbor, wharves, docks, and other accommodations necessary to connect the road with the business of the lake. That portion of the business of this road, destined to be connected with the Hudson River and New York, through the Northern Canal,—must, in the course of a few years, very far exceed that which the present harbor and wharves of Plattsburgh are capable of accommodating. At what cost this harbor and the system of docks may be so extended as to give reasonable promise of being able to accommodate the future business of the road,—and whether it *can be* so extended,—I have not had time and opportunity sufficiently to inform myself, to be able to give an opinion. I entertain a hope that the docks, &c. at that place, *may be* so extended as to be capable of accommodating that portion of the business destined to a southern direction upon the lake.

The *Cumberland Head* line, as surveyed, is identical with the *Plattsburgh* line, till within about five miles of that village. Here it diverges to the east, and reaches the navigable waters of the lake, about three miles east of *Plattsburgh*. This line is also very favorable for the construction of a railroad, and will probably, when resurveyed, be a little more than a mile, — possibly one and a half miles longer than the line to *Plattsburgh*. This line will reach the lake a little north of *Light House Point*, at a locality which will require protection, by *jetties* or piers, on either side of the lake, and of each place, where vessels are to be accommodated, for the security and safety of the steamboats and other water craft used in connection with the business of the road. The distance to the nearest part of *Grand Isle* is less than a mile and a half. The landing on that side will require about the same protection by artificial means, as that on the east side of *Cumberland Head*. Each of these harbors would require very great expense to render them spacious enough for the business of the road, and safe in all weathers for the number of vessels which would congregate at the *Railroad Ferry*, particularly at the *west end* of the ferry.

From the *eastern end* of this ferry, across the island, to the *sand bar*, so called, is about six miles. The route is perfectly feasible; not inconveniently circuitous, though not straight; and not very expensive. The *Sand Bar* is a *shoal* on the south-east side of the island, about *one mile* across, constituting a convenient ford-way for the islanders to communicate with the main land in the direction of *Burlington*, and the neighboring country. The depth of water across the bar is from one to three feet. There can be no objection to building a solid embankment across this bar, nor would it be very expensive. The earth for such an embankment is hard upon the shore opposite the bar; and plenty of the proper material to protect the embankment from the action of the water, is found within a short distance.

From this *ford* to the Central Railroad near *Burlington*, a survey has been made, under the direction of the officers of that Corporation; and I understand there is no difficulty in constructing a railroad there with easy grades.

The soundings at *Cumberland Head* give us a depth of over two hundred feet for several hundred feet together. This puts out of the question the idea of a bridge at that place; and the exposed position of the shores is such as to require a considerable expense for piers or breakwaters, to render the position safe and convenient for a ferry.

From a point in the line from the summit to *Plattsburgh*, just described, and eighteen miles from the latter place, we surveyed the line to *Rouse's Point*. This line passes near the villages of

Mooers, Perrysville, Champlain, and the landing at Rouse's Point. Since these surveys were suspended, we have made some farther examination of the country in the neighborhood of this line, and expect to make considerable improvement in it. The line already surveyed, however, assures us of a grade nowhere exceeding 39·6 feet to the mile; and has no curves of a less radius than 3,000 feet. The last three miles, as we approach the lake, will be perfectly straight, and the last mile perfectly level. The length of this line, on a final location, will probably be from *two to three miles less* than the line to Plattsburgh, and the curves will be enlarged to radii of 5,000 feet. The material to be excavated will be generally gravel,—much of it the best of gravel for a railroad. There may be a little rock cutting east of Champlain village; but this will probably be trifling.

The channels of the rivers, from the summit to Lake Champlain, are not deep. The bridges, in this part, will not be expensive. This stratified sand-stone, which underlies the whole northern part of Clinton County, is well adapted for the kind of masonry which will be required on this part of the road; and it is easily quarried in suitable blocks for the purpose.

These several lines have been surveyed with reference to the best accommodation of that business of the road which will connect itself with the navigation of the lake, and with reference to different methods of communicating with the avenues of travel and business, leading eastward and southward, on the Vermont side.

It has been proposed to connect this road with the railroads in Vermont, by a ferry of from twenty to twenty-five miles in length, extending from Plattsburgh to Burlington. But on account of the inconvenience, interruption, and expense of a ferry of such length, and the great superiority of a permanent road to a ferry of any length, I have thought it necessary to seek for some other *place*, or some other *method*, for crossing the lake. With this view, we have surveyed the two other lines mentioned above; one to Cumberland Head, and one to Rouse's Point.

In selecting the eastern terminus of this railroad, a variety of circumstances were to be considered. A large amount of business will go from this road through Lake Champlain to White Hall, and through the Northern Canal to Troy, Albany, and New York. This portion of the business will, as we have before stated, require a safe and commodious harbor, extensive wharves, and ample ranges of store-houses. The other portion of the business will seek a connection with Vermont, and the railroads leading to the East and the South. This portion of the business will demand the most safe and expeditious crossing of the lake,

at all seasons of the year, and in all states of the weather. Such a crossing can be secured only in *one way*,—by a *permanent bridge*. This is the *great desideratum*. In looking, therefore, to the accommodation of that portion of the business which is destined to the Vermont side of the lake, we have made examination of the lake shores and channels, with a view to the construction of a *bridge across its waters*. In this inquiry we have been entirely successful. In the neighborhood of the Canada line, near Rouse's Point, there is a beautiful site for a bridge at a very inconsiderable expense. The whole distance across is 3,880 feet; the length of way that has ten feet of water, and over, is only 2,000 feet. The location is perfectly protected by the projecting points of the opposite shores. A bridge of less than half a mile in length, in *ten feet* water at its abutments, and less than *twenty feet* at its maximum depth, will carry our cars to the Vermont shore in Alburgh. From this crossing there is a very direct and feasible route to the village of Swanton, crossing the outlet of Missisquoi Bay at Hog Island. This line has been surveyed; the distance across the Bay being about 3,900 feet; the greatest depth of water, only fifteen feet, and this only for a short distance, about two hundred yards. From the Bay to Swanton village, there is nothing to interfere with the location of a railroad on a nearly straight line of very gentle grades. Swanton is a manufacturing village of evident enterprise and thrift, and lies nearly in the direction from Rouse's Point to St. Albans—the shire town of Franklin County.

At Swanton we meet a line surveyed from that village to the neighborhood of Burlington, by WM. BECKWITH, Esq., under a charter authorizing the construction of a railroad from Canada, to connect with each of the two important railroads now in progress of construction through the State of Vermont.—These surveys show, that there is a perfectly feasible route for a railroad, at a reasonable expense, from Swanton village to the Central Railroad near Burlington,—and thence, *of course*, into the village; the whole distance from Rouse's point to Burlington being about 38 miles. I, therefore, consider the question of "*Bridging the Lake*," settled, so far as practicability and expediency are concerned.

This bridge at Rouse Point will subserve other important interests besides those of the Northern Railroad. It will connect all New England with Montreal, as well as with Ogdensburgh and the Lakes. Certain citizens of Montreal have given notice in the public papers of the Province, that application will be made to the Provincial Parliament, at its approaching session, for a charter to construct a railroad to the province line on the South; and we can entertain no doubt that the application will be granted.



The proposed location of the bridge is but twenty miles from the present *terminus of the Montreal and St. Johns Railroad*. The intervening country is perfectly level; and there can hardly be a doubt that *that* road will be extended to meet the New York and Vermont Railroads, as soon as they shall be completed.

A bridge across the lake, at or near Rouse's Point, for the use of the railroads which may centre there,—with a *draw* for the accommodation of the shipping which navigates the river between the lake and St. Johns,—is not only feasible, but it is neither difficult nor expensive. And it is not to be believed, that, when this subject shall be fairly examined by the legislature of either of the States having jurisdiction on those waters, such an application will be refused to the various public interests which ask for such an improvement.

With a bridge at Rouse's Point, and the Montreal Railroad extended to meet the New York and Vermont Railroads at this place,—the steam-boats which navigate the lake would doubtless stop at this new terminus of the Montreal Railroad, and thus relieve themselves of some twenty-five miles of the most difficult part of their route.

With the Montreal Railroad extended to this point, the whole distance from the shore of the river opposite Montreal, to Rouse's Point, may be easily run in *one hour*. This would shorten, by some *two hours*, the passage from Montreal to Rouse's Point, even in good weather,—and would add greatly to the facilities of steam navigation through Lake Champlain. It would shorten the time from Montreal to Burlington *four hours in good weather*. The difference in bad weather would, of course, be greater.

I feel confident that the objection, that the drawbridge obstructs the navigation, will not be interposed to prevent the erection of a bridge at that place, to subserve so important a public improvement; and that, if interposed by those who imagine they have an opposing interest, it will not be sustained by the legislature of either of the States.

Connected with this plan of bridging the lake at Rouse's Point, and there meeting the railroads from Montreal and from Burlington, it may be well to consider the expediency of constructing a branch of the railroad to Plattsburgh, or the most eligible point near that village, for a depot for that portion of the business of the railroad which is connected with the business of the lakes, and also for a junction with branch roads from the *Au Sable* and the Saranac valleys. These valleys constitute the great *iron district* of Northern New York, and will ultimately contribute an immense amount of business to the Vermont roads, as well as to the Ogdensburgh and Lake Champlain Railroad.

The expense of such a branch will be comparatively light. The distance is about sixteen miles ; and the country favorable.

The advantages of this method of crossing the lake by a bridge, with its collateral arrangements, are so obvious and so great, that they must commend themselves to the approbation of all persons interested in the navigation of the lake, or in the business of the railroads on either side. It connects the whole western border of Vermont, the centre, and the south-east, directly with Montreal, with Upper Canada, and the business of *the West*. It connects Montreal with the system of railroads which traverse the New England States and New York ; it connects Eastern and Central New York with the Northern frontier of the State ; and it secures to Plattsburgh and the valleys of the Saranac and the Au Sable Rivers—the rich *iron district* of Northern New York—the best connection which they can possibly have with the *East*, the *West*, the *North*, and the *South* ; and takes nothing from their present advantages, but adds incalculably to the business of all. It will, of course, be a great advantage to the Ogdensburgh and Lake Champlain Railroad, and in all these advantages the other roads east of it must share ; for it is manifestly against the interests of all the roads on the line, and of the communities which furnish the business, that the freight going in either direction should be, *in any part of the line*, taxed with unnecessary expense.

### *The Western Terminus of the Road.*

Though Ogdensburgh is the western *terminus* of the railroad, it is not to be the termination of the great business which this road is destined to subserve. It may be regarded only as a *midway station* in a new and important thoroughfare of travel and business, of which this road is but a small part ; one of the *results* of this road, if not one of its *objects*, being to open another channel for the business of *the West* through the State of New York, from the Great Lakes to the Hudson River valley ; for Lake Champlain lies in what may be considered a *continuation* of the valley of that river.

Ogdensburgh—the western terminus of the railroad—is at the foot of navigation for the great chain of lakes. It is connected by means of the river St. Lawrence, the Welland Canal, and this vast chain of lakes, with the peninsula of Upper Canada, with seven of the largest and most fertile States of the Union, and with a lake coast exceeding in extent, by about two thousand miles, the whole Atlantic border of the United States, from Passamaquoddy to Mexico. The commerce of these lakes is now, or is soon to be, connected, by the Illinois Canals and other improvements, with the Mississippi river and the business

of that extensive and fertile region. This section of country — perhaps the first, certainly among the first in the world, in natural fertility — is rapidly increasing in its resources and its commercial wants. Its increasing products will crowd eastward, and seek an exchange for the manufactures of the Eastern States, and the merchandise of the other quarters of the globe. It cannot, then, be matter of doubt that this road will be extensively used for the transportation of the produce of the West to Lake Champlain, to be thence taken to New York through the Northern Canal, or to Boston over the Vermont, New Hampshire, and Massachusetts Railroads; and that it will receive, in return from the watercraft of the lake and the canal, and from the railcars of the Vermont roads, those articles of commerce which the new country of the West does not yet produce for itself. A very important feature, therefore, of this road, is its connection with the navigation of the St. Lawrence and the lakes, by a suitable maritime depot at its western extremity. With reference to this connection, we have made a thorough survey of the river at Ogdensburgh; have obtained soundings of the New York side for about *three miles*; and have ascertained, that it is capable of affording the most ample accommodations for a large amount of shipping. The mouth of the Oswegatchie River, and the bays on either side of "*Mile Point*," afford room for several miles of wharves, a large amount of which would be protected in all winds; and the river itself, and the capacious bay between "*Mile Point*" and "*Indian Point*," constitute an excellent harbor or roadstead, where vessels may lie at anchor in perfect safety, in any weather.

Our surveys connect themselves with the river St. Lawrence, both above and below the mouth of the Oswegatchie; and, on whichever side of that river we locate the *terminus* of the road, it will be perfectly easy to have a rail track running alongside of the store-houses upon the wharves generally on that side of the Oswegatchie. Indeed, it will be easy to connect the railroad directly with several thousand feet in length of store-houses, at the doors of which the lake vessels may lie afloat, for loading and unloading their freight. I may further remark, that the location and position of the grounds offered the company for a depot for the lake business are such as to give, when finished, a very perfect arrangement; and will afford opportunity for a very great increase of accommodation, in the future growth of the business.

*A Summary of the Characteristics of the Road, when finished.*

1. *The grades* are more favorable than those of any other road, of the same length, in the Northern States; and they are conveniently disposed for the business which the railroad will be called to do. A large amount of the freighting business will be eastward from the St. Lawrence river, or from the rich agricultural district bordering on that stream, to Lake Champlain. And of the *way-business* generally, much the larger portion will go eastward towards the lake. The grades of the road favor this distribution of the *traffic*. The rising grades, going east, are generally gentle, none of them exceeding an elevation of *one foot in two hundred*, or 26.4 feet to the mile. The rising grades going westward from Lake Champlain to *the summit*—a distance, on the adopted line, of about 33 miles—average thirty-one feet to the mile. There is no descent in this direction, in this division of the road. In laying the planes for the estimates which we have made of the cost of the Eastern division, the greatest elevation which we have assumed is 39.6 feet to the mile [less than an inch and a half in a rod]. There is, however, but one plane of this grade, about 2.4 miles in length. In a final location, there will be no plane exceeding this inclination.

Beyond *the summit*, westward, there is no inclination exceeding 26.4 feet to the mile. Indeed, the whole aggregate of elevation to be overcome for eighty-four miles will be only two hundred and sixty feet; and, for the first forty-five miles, the aggregate rise will be only twenty-four feet.

2. A second characteristic of this road is its *remarkable freedom from inconvenient curvature*; there being only one curve of a less radius than *four thousand feet*; and that occurs at a *station*, where the trains will always move slow. The radius of this short curve will vary from two to three thousand feet. The portion of the curve having a less radius than three thousand feet will be on a level portion of the road. About eighty miles together are sufficiently straight to be run at the rate of forty miles to the hour, with as much safety as any road in the country. For nearly sixty miles there will be no curve of a less radius than 10,000 feet. Indeed, there is very little curvature between Ogdensburgh and the Clinton summit—about eighty-two miles. The Eastern Division has more of curvature; but there will probably be no curve of a less radius than *five thousand feet*; and there will be in this division about twenty-five miles of straight line.

*The practical result* to which we arrive is this: We can have, at a comparatively low cost, a railroad from Ogdensburgh to

Lake Champlain at Rouse's Point, one hundred and fifteen miles long, with no acclivity exceeding 26.4 feet to the mile (*less than one inch in a rod*), with no curves of a less radius than five thousand feet; and with *eighty-five per cent.* of the road perfectly straight.

With curves of four thousand feet radius, there will be *one hundred miles of straight line* between Ogdensburgh and the lake.

3. The character of the *grades* and *curves* places this road in the very first class of railroads in the country. Its capacity as a freight road is greater than that of any road of its length with which I am acquainted, — greater than any road entering Boston, not even excepting the Boston and Lowell road. Independent of the advantage to be derived from its freedom from exceptionable curvature, which is very great, its capacity for freighting is, to that of the Western Railroad, as 100 to 45, and to that of the New York and Erie Railroad, as 100 to 52. The advantage which it has over these roads on account of its straightness, is not susceptible of precise estimate; but it must add considerably to that stated above.

The capacity of this road as a freight road, compared with some of the principal railroads in the Northern States, so far as it depends on the grades, is shown in the following tabular view:

Ogdensburgh and Lake Champlain . . . . .	100
Vermont Central . . . . .	77
Northern Railroad, N. H. . . . .	66
Vermont and Massachusetts . . . . .	55½
The Cheshire and the Rutland Railroad . . . . .	55½
Western . . . . .	45
Boston and Lowell, and Boston and Worcester . . . . .	89
New York and Erie . . . . .	52
Boston and Providence . . . . .	82
Boston and Maine, in New Hampshire . . . . .	78
Boston and Maine to "Lawrence" . . . . .	100

4. As a passenger road, its character for directness is of great importance. This, together with its freedom from heavy grades, adapts it to fast driving. The whole road may be run, generally, from Ogdensburgh to Lake Champlain, in about three and a half hours, or *thirty-three miles an hour, including stops*; and, with a good bridge across the waters of the lake, at Rouse's Point, four and a half or five hours would be ample between Ogdensburgh and Burlington.

I cannot close this report without acknowledging my obligation to H. K. Curtis, T. J. Carter, E. Appleton, and A. W. Hoyt,

Esquires — engineers of the several divisions — for the able manner in which they have executed the surveys, and for the aid which they have rendered me in the discharge of my own appropriate duties in this investigation. It is owing, in a great measure, to the skill and efficiency of these gentlemen, that I am able to present, at this time, so full and so satisfactory an exhibition of the capabilities and characteristics of this line of road.

With the foregoing statements of the character of the country and the results of the surveys, the following estimates are respectfully submitted by

Your obedient servant,

JAMES HAYWARD.

## TABLE OF GRADES.

*Western Division — Ogdensburg to Moira.*

No.	Stations.	LEVEL.	ASCENDING.			DESCENDING.			HEIGHT ABOVE TIDE.	
		Length in feet.	Rate per mile.	Length in feet.	Rise.	Rate per mile.	Leg'h in ft.	Fall.		
1	6 to 28	2,200							237	Ogdensburg Depot.
2	28 — 98		26.4	7,000	35				272	
3	98 — 147	4,900							272	
4	147 — 223		26.4	7,600	38				310	
5	223 — 273	5,000							310	
6	273 — 300		26.4	2,700	13.5				323 50	
7	300 — 368					14.3	6,800	18.5	305	
8	368 — 403	3,500							305	
9	403 — 433		26.4	2,400	12				317	
10	433 — 504	7,100							317	
11	504 — 542		26.4	3,800	19				336	O. Hara Ridge.
12	542 — 578	3,600							336	
13	578 — 663					3.1	8,500	5	331	
14	663 — 713					26.4	5,000	25	306	
15	713 — 858	14,500							306	
16	858 — 920					26.4	6,200	31	275	Grasse River. Columbia.
17	920 — 926	600							275	
18	926 — 980		26.4	5,400	27				302	
19	980 — 996	1,600							302	
20	996 — 1,024					26.4	2,800	14	288	
21	1,024 — 1,028	400							288	
22	1,028 — 1,066		26.4	3,800	19				307	
23	1,066 — 1,086	2,000							307	
24	1,086 — 1,114					26.4	2,800	14	293	
25	1,114 — 1,188		26.4	7,400	37				330	
26	1,188 — 1,199	1,100							330	Racket River.
27	1,199 — 1,217					14.6	1,800	5	325	
28	1,217 — 1,247					26.4	3,000	15	310	
29	1,247 — 1,295		11	4,800	10				320	
30	1,295 — 1,315	2,000							320	
31	1,315 — 1,331		26.4	1,600	8				328	
32	1,331 — 1,350	1,900							328	
33	1,350 — 1,380		3.5	3,000	2				330	
34	1,380 — 1,418		26.4	3,800	19				349	
35	1,418 — 1,436					26.4	1,800	9	340	
36	1,436 — 1,450.45	1,445							340	
37	1,450.45 — 1,477		26.4	2,800	14				354	
38	1,477 — 1,566					22.1	8,900	38	316	
39	1,566 — 1,680		7.8	11,400	17				333	
40	1,680 — 1,718		26.4	3,800	19				352	
41	1,718 — 1,751	3,300							352	St. Regis River.
42	1,751 — 1,788					10	3,700	7	345	
43	1,788 — 1,862					26.4	7,400	37	308	
44	1,862 — 1,911	4,835							308	
45	1,911 — 1,947					26.4	3,600	18	290	
46	1,947 — 1,960	1,300							290	
47	1,960 — 2,004		26.4	4,400	22				312	
48	2,004 — 2,030					8.1	2,600	4	308	
49	2,030 — 2,050		15.5	2,000	6				314	
50	2,050 — 2,135	8,500							314	
51	2,135 — 2,155		26.4	2,000	10				324	Deer River.
52	2,155 — 2,180	2,500							324	
53	2,180 — 2,209					12.8	2,900	7	317	
54	2,209 — 2,225		26.4	1,600	8				325	
55	2,225 — 2,245	2,000							325	
56	2,245 — 2,321		26.4	7,600	38				363	
57	2,321 — 2,341	2,000							363	
58	2,341 — 2,361					26.4	2,000	10	353	
59	2,361 — 2,431		4.5	7,000	6				359	
60	2,431 — 2,447					9.9	1,600	3	356	
61	2,447 — 2,551		26.4	10,400	52				408	Brush's Mills.
62	2,551 — 2,593	4,200							408	
63	2,593 — 2,606		26.4	1,300	6.5				414 50	
		80,480	107,600 438			71,400 280.5				

**TABLE OF GRADES.**  
*Middle Division — Brush's Mills to Summit.*

No.	STATIONS.	LEVEL.	ASCENDING.			DESCENDING.			HEIGHT ABOVE TIDE.	
		Length, Feet.	Rate perm.	Length, Feet.	Rise.	Rate per m.	Length Feet.	Fall.		
	Station 4								414.50	Brush's M.
1	—4 to 560		26.4	56,400	282				696'	
2	560 to 600	4,000							696'	Malone Sta.
3	600 to 700		26.4	10,000	50				746'	
4	700 to 720					26.4	2,000	10	736'	
5	720 to 740	2,000							736'	
6	740 to 910		26.4	17,000	85				821'	
7	910 to 950	4,000							821'	
8	950 to 1290		26.4	31,000	155				976'	Chateaugay
9	1290 to 1278	1,800							976'	
10	1278 to 1448		26.4	17,000	85				1061'	
11	1448 to 1545	9,700							1061'	
12	1545 to 1605		26.4	6,000	30				1091'	
13	1605 to 1610	500							1091'	
14	1610 to 1640					26.4	3,000	15	1076'	
15	1640 to 1720		13.2	8,000	20				1096'	
16	1720 to 1727.50	750							1096'	Summit.
		22,750		145,400	707		5,000	25		

**TABLE OF GRADES.**  
*Eastern Division — Summit to Lake Champlain.*

No.	STATIONS.	LEVEL.	ASCENDING.			DESCENDING.			HEIGHT ABOVE LAKE CHAMPL.	
		Length, Feet.	Rate per m.	Length, Feet.	Rise.	Rate per m.	Length, Feet.	Fall.		
1	1764 to 9		7.50	4,000	6.40				1022.60	Summit.
2	9 to 96					19.2	8,700	31.58	991.02	
3	96 to 820					39.	72,400	535.10	455.92	
4	820 to 848					28.14	2,800	14.92	441.	
5	848 to 976					39.6	12,800	96	345.	
6	976 to 1028					30.	5,200	29.64	315.36	
7	1028 to 1120					28.	9,200	48.95	266.41	
8	1120 to 1208					16.20	8,800	26.03	239.48	
9	1208 to 1305					38.8	9,700	71.49	167.99	
10	1305 to 1380					4.22	7,500	6.	161.99	
11	1380 to 1427					26.67	4,700	23.92	138.07	
12	1427 to 1508					5.28	8,100	8.1	129.97	
13	1508 to 1623					37.5	11,500	81.99	47.98	
14	1623 to 1678					16.40	5,500	17.05	30.93	
15	1678 to 1747					1.65	6,900	2.14	28.79	
16	1747 to 1791	4,400							28.79	
17	1791 to 1818					30.	2,700	15.34	13.45	
18	1818 to 1835	1,700							13.45	Lake. Champl'n.
		6,100		4,000	6.40		176,500	1009.15		



## ESTIMATES.

*Estimated Cost of One Mile of Superstructure.*

Iron Rails, 60 lbs. to the yard = 95 tons; at \$75 .	\$7,125 00
Chairs, 555, 20 lbs. each = 11,100 lbs.; at $2\frac{3}{4}$ cts. .	305 25
Spikes, 4545 lbs. at $5\frac{1}{2}$ cts. per lb. . . . .	250 00
Ties, 2200, Kyanized, at 30 cts. . . . .	660 00
Plank, 25 M. at \$8 . . . . .	200 00
Laying track, straightening and fitting rails, &c. .	459 75
Total cost of one mile of track . . . . .	<u>\$9,000 00</u>

## WESTERN DIVISION.

*Ogdensburgh to Brush's Mills, 49.13 miles.*

1,084,940 yards of earth at $16\frac{7}{10}$ cts. per yard .	\$181,453 60
19,885 yards of rubble masonry . . . . .	37,653 00
1610 yards of arch masonry . . . . .	5,970 00
1168 feet of bridging . . . . .	15,176 00
31 road signs at \$40 each . . . . .	1,240 00
96 road and farm crossings at \$10 each . . . . .	960 00
207.6 acres of clearing at \$10 per acre . . . . .	2,976 00
78 acres of grubbing at \$100 per acre . . . . .	7,800 00
42 miles of fencing at \$500 per mile . . . . .	21,000 00
Foundations for masonry . . . . .	2,000 00
49.13 miles of superstructure at \$9,000 per mile .	442,260 00
	<u>\$718,488 60</u>

## MIDDLE DIVISION. 33.86 miles.

1,092,000 yards of earth work at $16\frac{3}{16}$ cts. per yd.	\$178,460 00
15,000 yards of rock excavation at 75 cts. per yd.	11,250 00
3,802 yards of culvert masonry at \$1.75 per yd.	6,653 50
3,355 yards of small arches and road bridge, masonry, \$3 . . . . .	10,065 00
6,277 yards of arch masonry, for river bridges	18,819 75
3,223 yards of arch masonry at Salmon river, Malone . . . . .	13,000 00
2,331 yards of masonry at Little Falls, Chateaugay river . . . . .	11,655 00
650 feet of truss bridging at \$25 per foot . . . . .	16,250 00
155.26 acres of clearing at \$10 per acre . . . . .	1,552 60
18.82 acres of grubbing at \$100 per acre . . . . .	1,882 00
4 road bridges . . . . .	1,300 00
22 road crossings at \$50 each . . . . .	1,100 00
89 farm crossings at \$15 each . . . . .	1,335 00
30 cattle passes at \$110 each . . . . .	3,300 00
5 farm bridges . . . . .	1,700 00
Alteration of roads . . . . .	500 00
32.5 miles of fencing at \$500 per mile . . . . .	16,250 00
32.86 miles of superstructure at \$9,000 per mile	295,740 00
	<hr/>
	\$590,812 85

## EASTERN DIVISION.

1,089,269 yards of earth work . . . . .	\$174,283 04
157,556 yds. of rock excavation, at 76 $\frac{3}{10}$ cts. per yd. . . . .	120,288 00
7,808 yards of culvert masonry . . . . .	15,609 11
1,020 yards of bridge do at \$6.50 per yard . . . . .	6,630 00
1,338 yards of do. do. at \$4.00 per yard . . . . .	5,352 00
180 feet of bridging at \$18.00 per foot . . . . .	3,240 00
80 feet of bridging at \$15.00 per foot . . . . .	1,200 00
140 feet of bridging at \$14.00 per foot . . . . .	1,960 00
10454 square rods of grubbing at \$75 per rod . . . . .	7,840 50
298.1 acres of clearing at \$20 per acre . . . . .	5,962 00
9356 rods of fencing at 50 cts per rod . . . . .	4,678 00
Foundations for bridges and culverts . . . . .	4,770 00
Altering roads and making drains . . . . .	2,435 00
35.34 miles of superstructure at \$9,000 per mile . . . . .	318,060 00
	<hr/>
	\$672,307 65

## GENERAL SUMMARY OF COST.

Estimates for the Western Division . . . . .	\$718,488 60
“ “ “ Middle Division . . . . .	590,812 85
“ “ “ Eastern Division . . . . .	672,307 65
Add for five miles of side track . . . . .	45,000 00
Contingencies, engineering, &c., 10 per cent. . . . .	202,660 90
	<hr/>
	\$2,229,270 00
Equal to \$19,000 per mile.	

